

REMARKS

Claims 1-8, 10-13, 15, 17, 18, 20 and 22 were pending. New claims 23-32 are added herein. Thus claims 1-8, 10-13, 15, 17, 18, 20, 22-32 are now pending. The applicants respectfully request reconsideration and allowance of this application in view of the above amendments and the following remarks.

Claims 1-8, 10-13, 15, 17, 18, 20 and 22 were objected to since the second tip end lacked proper antecedent basis. Claim 1 is amended herein to, *inter alia*, address the objection.

Claims 1-2, 15 and 17 stand rejected under 35 USC 102(b) as being anticipated by Johnson, U.S. Patent No. 5,430,346 (hereinafter "Johnson"). The applicants respectfully request that this rejection be withdrawn for the following reasons.

Claim 1 is amended herein to clarify that the ground electrode is opposed to the outer peripheral surface of the center electrode and that the ground electrode has a second tip end facing the outer peripheral surface substantially along a line extending perpendicular to the longitudinal center line of the center electrode and intersecting the outer peripheral surface. Johnson, at best, shows a ground electrode 12 extending horizontally only from the posts 38. At best, as is clearly shown, for example, in Fig. 26 of Johnson, an outer peripheral surface (bottom surface 58) of a center electrode opposes a post 38 and thus does not oppose, in the manner claimed, a second tip of a ground electrode, does not define a spark gap, and does not face substantially along a line extending perpendicular to the longitudinal center line of the center electrode and intersecting the outer peripheral surface as recited in claim 1 as amended.

Claim 1 is further amended to recite that the laser fused weld has a predetermined melt depth *d*. Support for the amendment can be found in Applicant's specification in the paragraph beginning at page 18, line 23 and elsewhere in the specification. Applicant further notes that the

predetermined melt depth d amounts to a structural feature not disclosed in Johnson and having certain advantages as will be discussed hereinbelow.

The advantage of the predetermined melt depth d of the laser fused weld is shown in the graph of FIG. 8 showing that the joint strength shows excellent and unexpected strength characteristics by controlling the weld to a predetermined depth d . During a durability test of a spark plug constructed using, *inter alia*, the inventive weld melt depth, a counter-intuitive result is reached in that with increasing melt depth over 1.5 mm, the joint strength of the weld drops drastically due to solidification caused breakage. Johnson fails to describe any significance of the melt depth of the weld joint and therefore cannot be said to disclose either, expressly or inherently, a predetermined melt depth d of a laser fused weld particularly since Johnson fails to specifically disclose a laser fused weld as noted in previous response and as essentially admitted by the Examiner.

Accordingly, applicant submits that a *prima facie* case of anticipation cannot be sustained with regard to independent claim 1, as amended, since all of the claimed features are not disclosed in the applied reference in the manner claimed. It is respectfully requested that the rejection of claim 1 be reconsidered and withdrawn. Claims 2, 15 and 17, by virtue of depending from claim 1 are allowable for at least the reasons set forth herein above with regard to claim 1. It is respectfully requested that the rejection of claims 2, 15 and 17 be reconsidered and withdrawn.

Claim 3 stands rejected under 35 USC 103(a) as being unpatentable over Johnson. The applicants respectfully request that this rejection be withdrawn for the following reasons.

Claim 3 is allowable by virtue of depending from claim 1 and is also independently allowable for the following reasons. As noted above, the applicant specifically discovered that

the melt depth d of the weld is critical in providing good joint strength during operation of the spark plug. The Examiner argues that the melt depth of the weld would have been obvious as being included in a workable range of values which could be optimized. However, the Examiner has failed to show that the welding depth is a results-effective variable as required and therefore, particularly given the evidence of unexpected results from the results described and shown in connection with FIG. 8, cannot simply assert that the claimed feature would have been obvious as falling within a workable range of optimization.

Accordingly, it is respectfully requested that the rejection of claim 3 be reconsidered and withdrawn.

Claims 4, 5, 11 and 12 stand rejected under 35 U.S.C. 103 (a) as being allegedly unpatentable over Johnson in view of Takafumi et al JP 63-266046. The rejection is respectfully traversed.

By virtue of depending from claim 1, claims 4, 5, 11 and 12 are allowable for at least the reasons set forth herein above. The rejection of claims 4, 5, 11 and 12 should therefore be withdrawn.

Claims 7, 8, 10, 13, 18 and 20 stand rejected under 35 U.S.C. 103 (a) as being allegedly unpatentable over Johnson in view of Franks U.S. Patent No. 3,958,144. By virtue of depending from claim 1, claims 7, 8, 10, 13, 18 and 20 are allowable for at least the reasons set forth herein above. The rejection of claims 7, 8, 10, 13, 18 and 20 should therefore be withdrawn.

Claims 1, 6 and 22 stand rejected under 35 U.S.C. 103 (a) as being allegedly unpatentable over Pfeil, U.S. Patent No. 2,406,966 in view of Johnson. The rejection is respectfully traversed.

With regard to claim 1, as amended, the claimed feature of a laser fused weld having a predetermined melt depth d is not recited in Pfeil and thus in the applied art combination. In

particular, Pfeil, as admitted by the Examiner, fail to teach or suggest, for example, laser fused welding of the ground electrode. Likewise, Johnson teaches only unspecified laser fused welding along with other conventional methods. Neither of the applied references, Johnson or Pfeil, teaches melt depth as a results effective variable. Further, neither of the applied references, Johnson or Pfeil, teaches a laser fused weld having any particular depth and therefore cannot be fairly said to teach or suggest a predetermined melt depth d . Given the criticality of the depth as describe in applicant's specification, for example in connection with FIG. 8, the claimed depth cannot be dismissed as simply a matter of routine experimentation.

Further, for the reasons set forth above with regard to Johnson, the applied art combination fails to teach or suggest that the ground electrode has a second tip end facing the outer peripheral surface of a center electrode substantially along a line extending perpendicular to the longitudinal center line of said center electrode and intersecting the outer peripheral surface. Pfeil fails to account for this deficiency.

Accordingly a *prima facie* case of obviousness cannot be sustained in that the applied art combination fails to teach or suggest all the claimed features as required. It is respectfully requested therefore that the rejection of claim 1, as amended, be reconsidered and withdrawn.

Claims 6 and 22, by virtue of depending from claim 1 are allowable for at least the reasons set forth hereinabove with regard to claim 1. It is respectfully requested that the rejection of claims 6 and 22 be reconsidered and withdrawn.

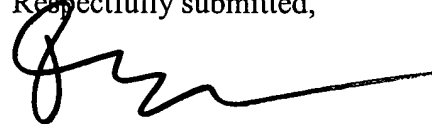
New claims 23-32 are added herein to recite various novel embodiments including some previously submitted in connection with dependencies of claim 1. Independent claim 23 recites a spark plug including, *inter alia*, a ground electrode extending horizontally from a metal shell and opposed to a first tip end of a center electrode to define a spark gap between said ground electrode and said center electrode, said ground electrode being connected to said metal shell

through a laser fused weld having a predetermined melt depth d . For the reasons set forth hereinabove, applicant contends that the art of record and the prior art fails to disclose or teach or suggest a predetermined melt depth d of a laser fused weld. The ground electrode further has a second tip end facing the first tip end of the center electrode, substantially along a longitudinal center line of said center electrode and specifically recites that the laser fused weld is located far from the second tip end to avoid a rise in temperature of the weld. Support for this embodiment can be found for example in applicant's specification on page 12, line 13 and elsewhere in applicant's specification. By locating the weld far from the end, the intense heat caused during operation will not operate to weaken the joint associated with the weld as is the case with prior art approaches. Applicant further notes that, for example, in claim 32, the laser fused weld is recited as including a predetermined number of fused portions, the predetermined number decreased to increase the joint strength of the laser fused weld as described for example, on page 12 line 17 of applicant's specification. Accordingly, new claims 23-32 are believed distinguishable over the prior art. Favorable consideration is respectfully requested.

In view of the foregoing, the applicants submit that this application is in condition for allowance. A timely notice to that effect is respectfully requested. If questions relating to patentability remain, the Examiner is invited to contact the undersigned by telephone.

If there are any problems with the payment of fees, please charge any underpayments and credit any overpayments to Deposit Account No. 50-1147.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'R. L. Scott, II', written over a horizontal line.

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